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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
HARRISON, MONICA D	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 12/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/799,146	WANG ET AL.	
	Examiner	Art Unit	
	Monica D. Harrison	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 March 2004* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 0904, 06/05, 08/05, 11/05
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-37 are rejected under 35 U.S.C. 102(e) as being anticipated by Schmitt et al (6,913,992 B2).

1. Regarding claim 1, Schmitt et al discloses a method for processing a substrate in a processing chamber comprising: positioning the substrate in a processing chamber (column 2, lines 45-58); introducing a processing gas into the processing chamber, wherein the processing gas comprises one or more hydrocarbon compounds and an argon carrier gas (column 4, lines 34-67 thru column 5, lines 1-13); generating a plasma of the processing gas by applying power from a dual- frequency RF source (column 5, lines 58-65); and depositing an amorphous carbon layer on the substrate (column 5, lines 58-65; *silicon carbide*).

2. Regarding claim 2, Schmitt et al discloses further comprising etching the amorphous carbon layer to form a patterned amorphous carbon layer (column 11, lines 49-51).

3. Regarding claim 3, Schmitt et al discloses wherein the one or more hydrocarbon compounds have the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10 (column 4, lines 33-67).

4. Regarding claim 4, Schmitt et al discloses wherein the one or more hydrocarbon compounds are selected from the group consisting of propylene (C_3H_6), propyne (C_3H_4), propane (C_3H_8), butane (C_4H_{10}), butylene (C_4H_8), butadiene (C_4H_6), acetelyne (C_2H_2), and combinations thereof (column 4, lines 33-67).

5. Regarding claim 5, Schmitt et al discloses removing the amorphous carbon layer from the substrate using a hydrogen-containing plasma, an oxygen-containing plasma, or combination thereof (column 9, lines 52-58).

6. Regarding claim 6, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power at a first frequency and applying a second RF power at a second frequency less than the first frequency (column 9, lines 59-67 thru column 10, lines 1-3).

7. Regarding claim 7, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power between at a first frequency between about 10 Mhz and and about 30 Mhz applying a second RF power at a second frequency between about 100 kHz and about 500 KHz (column 9, lines 64-67 thru column 10, lines 1-3).

8. Regarding claim 8, Schmitt et al discloses wherein the ratio of second RF power to first RF power is less than about 0.6:1 (column 9, lines 64-67 thru column 10, lines 1-3).

9. Regarding claim 9, Schmitt et al discloses a method for processing a substrate in a processing chamber, comprising: forming a dielectric material layer on a surface of the substrate (Figure 1, reference 110); depositing one or more amorphous carbon layers on the dielectric material layer by a process comprising (Figure 1, reference 114): introducing a processing gas comprising one or more hydrocarbon compounds and an argon carrier gas (column 4, lines 36-67 thru column 5, lines 1-13); generating a plasma of the processing gas by

applying power from a dual-frequency RF source (column 5, lines 14-57); etching the one or more amorphous carbon layers to form a patterned amorphous carbon layer (column 11, lines 49-54); and etching feature definitions in the dielectric material layer corresponding to the patterned one or more amorphous carbon layers (column 11, lines 55-65).

10. Regarding claim 10, Schmitt et al discloses removing the one or more amorphous carbon layers (Figure 2C, reference 114); and depositing a conductive material on the surface of the substrate (Figure 2F, reference 126).

11. Regarding claim 11, Schmitt et al discloses depositing an anti-reflective coating on the one or more amorphous carbon layers (Figure 2E, reference 118); and patterning resist material on the anti-reflective coating (Figure 2E, reference 122); and etching the anti-reflective coating prior to or concurrent with etching the one or more amorphous carbon layers (column 13, lines 1-22).

12. Regarding claim 12, Schmitt et al discloses wherein the hydrocarbon compound has the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10 (column 4, lines 33-67).

13. Regarding claim 13, Schmitt et al discloses wherein the one or more hydrocarbon compounds are selected from the group consisting of propylene (C_3H_6), propyne (C_3H_4), propane (C_3H_8), butane (C_4H_{10}), butylene (C_4H_8), butadiene (C_4H_6), acetelyne (C_2H_2), and combinations thereof (column 4, lines 33-67).

14. Regarding claim 14, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power at a first frequency and applying a second RF power at a second frequency less than the first frequency (column 9, lines 59-67 thru column 10, lines

1-3).

15. Regarding claim 15, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power between at a first frequency between about 10 Mhz and about 30 Mhz applying a second RF power at a second frequency between about 100 kHz and about 500 KHz (column 9, lines 64-67 thru column 10, lines 1-3).

16. Regarding claim 16, Schmitt et al discloses wherein the ratio of second RF power to first RF power is less than about 0.6:1 (column 9, lines 64-67 thru column 10, lines 1-3).

17. Regarding claim 17, Schmitt et al discloses wherein at least one of the one or more amorphous carbon layers comprise an anti-reflective coating (Figure 2E, reference 114).

18. Regarding claim 18, Schmitt et al discloses wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof (Figure 2E, reference 114).

19. Regarding claim 19, Schmitt et al discloses further comprising depositing a barrier layer prior to depositing the dielectric material (Figure 1, reference 112).

20. Regarding claim 20, Schmitt et al discloses further comprising removing the resist material prior to etching feature definitions in the dielectric layer (column 13, lines 9-37).

21. Regarding claim 21, Schmitt et al discloses wherein the etch selectivity of amorphous carbon to the dielectric material is greater than about 1:10 (Figure 1).

22. Regarding claim 22, Schmitt et al discloses a method for processing a substrate, comprising: depositing one or more dielectric layers on a substrate surface, wherein the one or more dielectric layers comprise silicon, oxygen, and carbon and has a dielectric constant of about 3 or less (Figure 1, reference 110, 115 and 118); forming one or more amorphous carbon

layers on the one or more dielectric layers by a process comprising (Figure 1, references 112 and 114): introducing a processing gas comprising one or more hydrocarbon compounds and an argon carrier gas (column 4, lines 34-67 thru column 5, lines 1-13); generating a plasma of the processing gas by applying power from a dual-frequency RF source (column 5, lines 14-57); defining a pattern in at least one region of the one or more amorphous carbon layers (column 11, lines 53-58); forming feature definitions in the one or more dielectric layers by the pattern formed in the at least one region of the one or more amorphous carbon layers (Figure 1, reference 116); and depositing one or more conductive materials in the feature definitions (Figure 2H, reference 126).

23. Regarding claim 23, Schmitt et al discloses further comprising removing the one or more amorphous carbon layers by exposing the one or more amorphous carbon layers to a plasma of a hydrogen-containing gas prior to depositing one or more conductive materials in the feature definitions (Figure 2C, reference 114).

24. Regarding claim 24, Schmitt et al discloses wherein the hydrogen-containing gas comprises a gas selected from the group of hydrogen, ammonia, water vapor, and combinations thereof (column 5, lines 24-42).

25. Regarding claim 25, Schmitt et al discloses wherein the plasma is generated by applying a power level between about 0.15 watts/cm.sup.2 and about 5 watts/cm.sup.2 to the chamber between for between about 10 seconds and about 120 seconds (column 5, lines 43-57).

26. Regarding claim 26, Schmitt et al discloses polishing the one or more conductive materials and stopping on the one or more amorphous carbon layers (column 13, lines 1-37); and removing the one or more amorphous carbon layers by exposing the one or more

amorphous carbon layers to a plasma of a hydrogen-containing gas (Figure 2H, reference 114).

27. Regarding claim 27, Schmitt et al discloses depositing an anti-reflective coating on the one or more amorphous carbon layers (Figure 2H, reference 118); and patterning resist material on the anti-reflective coating (Figure 2H, reference 122); and etching the anti-reflective coating prior to or concurrent with etching the one or more amorphous carbon layers (column 13, lines 1-22).

28. Regarding claim 28, Schmitt et al discloses wherein the hydrocarbon compound has the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10 (column 4, lines 33-67).

29. Regarding claim 29, Schmitt et al discloses wherein the one or more hydrocarbon compounds are selected from the group consisting of propylene (C_3H_6), propyne (C_3H_4), propane (C_3H_8), butane (C_4H_{10}), butylene (C_4H_8), butadiene (C_4H_6), acetelyne (C_2H_2), and combinations thereof (column 4, lines 33-67).

30. Regarding claim 30, Schmitt et al discloses wherein the one or more hydrocarbon compounds further comprises one or more fluorinated derivatives of the one or more hydrocarbon compounds (column 6, lines 18-47).

31. Regarding claim 31, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power at a first frequency and applying a second RF power at a second frequency less than the first frequency (column 9, lines 59-67 thru column 10, lines 1-3).

32. Regarding claim 32, Schmitt et al discloses wherein the generating the plasma comprises applying a first RF power between at a first frequency between about 10 Mhz and

about 30 Mhz applying a second RF power at a second frequency between about 100 kHz and about 500 KHz (column 9, lines 64-67 thru column 10, lines 1-3).

33. Regarding claim 33, Schmitt et al discloses wherein the ratio of second RF power to first RF power is less than about 0.6:1 (column 9, lines 64-67 thru column 10, lines 1-3).

34. Regarding claim 34, Schmitt et al discloses wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof (Figure 2F, reference 114).

35. Regarding claim 35, Schmitt et al discloses further comprising depositing a barrier layer prior to depositing the at least one dielectric material (Figure 1, reference 112).

36. Regarding claim 36, Schmitt et al discloses wherein the etch selectivity of amorphous carbon to the dielectric material is greater than about 1:10 (Figure 1).

37. Regarding claim 37, Schmitt et al discloses wherein at least one of the one or more amorphous carbon layers comprise an anti-reflective coating (Figure 2F, reference 114).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Monica D. Harrison
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mdh
December 16, 2005

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